

CARIBBEAN EXAMINATIONS COUNCIL

CARIBBEAN SECONDARY EDUCATION CERTIFICATE®
EXAMINATION

06 MAY 2019 (p.m.)



FILL IN ALL THE INFORMATION REQUESTED CLEARLY IN CAPITAL LETTERS.

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SUBJECT CHEMISTRY – Paper 032

PROFICIENCY GENERAL

REGISTRATION NUMBER

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SCHOOL/CENTRE NUMBER

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NAME OF SCHOOL/CENTRE

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CANDIDATE'S FULL NAME (FIRST, MIDDLE, LAST)

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DATE OF BIRTH

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SIGNATURE _____

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FORM TP 2019055



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MAY/JUNE 2019

CARIBBEAN EXAMINATIONS COUNCIL

CARIBBEAN SECONDARY EDUCATION CERTIFICATE®
EXAMINATION

CHEMISTRY

Paper 032 – General Proficiency

ALTERNATIVE TO SCHOOL-BASED ASSESSMENT

2 hours 10 minutes

READ THE FOLLOWING INSTRUCTIONS CAREFULLY.

1. This paper consists of THREE questions. Answer ALL questions.
2. Write your answers in the spaces provided in this booklet.
3. DO NOT write in the margins.
4. Where appropriate, ALL WORKING MUST BE SHOWN in this booklet.
5. You may use a silent, non-programmable calculator to answer questions.
6. If you need to rewrite any answer and there is not enough space to do so on the original page, you must use the extra lined page(s) provided at the back of this booklet. **Remember to draw a line through your original answer.**
7. **If you use the extra page(s) you MUST write the question number clearly in the box provided at the top of the extra page(s) and, where relevant, include the question part beside the answer.**

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Answer ALL questions.

1. (a) Volumetric analysis is a very useful technique which can provide a quick way of accurately determining the unknown concentration of solutions. In this experiment you are required to determine the concentration of an aqueous solution of sodium hydroxide (NaOH) by titrating it against a standard aqueous solution of hydrochloric acid (HCl). The endpoint of the titration is identified with screened methyl orange (SMO) indicator.

Materials

You are provided with the following:

- **Solution A:** 200 cm³ of aqueous 0.080 mol dm⁻³ hydrochloric acid (HCl)
- **Solution B:** 200 cm³ of aqueous sodium hydroxide (NaOH) of unknown concentration
- One 25 cm³ pipette
- One 50 cm³ burette
- Three conical flasks (250 cm³)
- A white tile (or firm white paper)
- Screened methyl orange (SMO) indicator with dropper
- Pipette filler
- Small filter funnel

Procedure

1. Rinse the burette with approximately 5 cm³ of **Solution A**, then fill the burette with **Solution A**.
2. Rinse the 25 cm³ pipette with approximately 5 cm³ of **Solution B**.
3. Pipette 25 cm³ of **Solution B** into a conical flask.
4. Add TWO drops of the SMO indicator into the conical flask containing **Solution B** and gently swirl.
5. Titrate the solution in the conical flask with the solution in the burette until the indicator changes to a grey (almost colourless) endpoint.
6. Repeat Steps 3–5 until consistent results are obtained but do NO MORE than THREE titrations.
7. Record your volume readings to TWO decimal places in Table 1.

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(i) **TABLE 1: TITRATION RESULTS**

Burette Readings (cm³)	Titration 1	Titration 2	Titration 3
Final volume			
Initial volume			
Volume used			

(9 marks)

- (ii) Calculate the average volume of **Solution A** used in the titration. Indicate in Table 1, using an asterisk (*), the titrations used for this calculation.

(2 marks)

- (iii) Calculate the number of moles of hydrochloric acid in the average volume of **Solution A** determined in (a) (ii).

(2 marks)

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- (iv) Write a balanced chemical equation for the reaction between sodium hydroxide and hydrochloric acid.

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(1 mark)

- (v) Determine the number of moles of sodium hydroxide in the volume of **Solution B** used in the titration.

(2 marks)

- (vi) Calculate the number of moles of sodium hydroxide in 1000 cm³ of **Solution B**.

(2 marks)



- (b) You are provided with an unknown solution labelled **Solution C**. Carry out the following tests and complete the observation and inference columns in Table 2.

TABLE 2: RESULTS OF TESTS ON SOLUTION C

Test	Observation	Inference
(i) • Divide Solution C into two equal portions. To the first portion, add aqueous sodium hydroxide, dropwise. • Then add aqueous sodium hydroxide in excess.	• •	• •
(ii) • To the second portion of Solution C , add aqueous barium chloride. • Then add dilute hydrochloric acid.	• •	• •

(8 marks)

Total 26 marks

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2. The effect of thiosulfate concentration on the rate of reaction was investigated using the reaction between sodium thiosulfate and dilute hydrochloric acid. This is usually referred to as the “Disappearing Cross” Experiment. The data obtained from this investigation is represented in Table 3.

TABLE 3: EXPERIMENTAL DATA FROM DISAPPEARING CROSS EXPERIMENT

Volume of 0.1 mol dm ⁻³ Sodium Thiosulfate Solution/cm ³	Volume of Deionized Water/cm ³	Time/s	Rate of Reaction $\frac{1}{\text{Time}} / \text{s}^{-1}$
0.0	10	0	0.0
2.0	8.0	240	0.004
4.0	6.0	125	0.008
6.0	4.0	75	0.013
8.0	2.0	55	0.018

- (a) Using the grid provided in Figure 1 on page 11, plot a graph of rate of reaction versus volume of sodium thiosulfate. Circle the plotted points on the graph, ⊗, and draw the line of best fit.

(6 marks)

- (b) State THREE variables that should be kept constant when this experiment is being carried out.

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(3 marks)

- (c) State ONE precaution that should be taken during this experiment.

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(1 mark)

Total 10 marks

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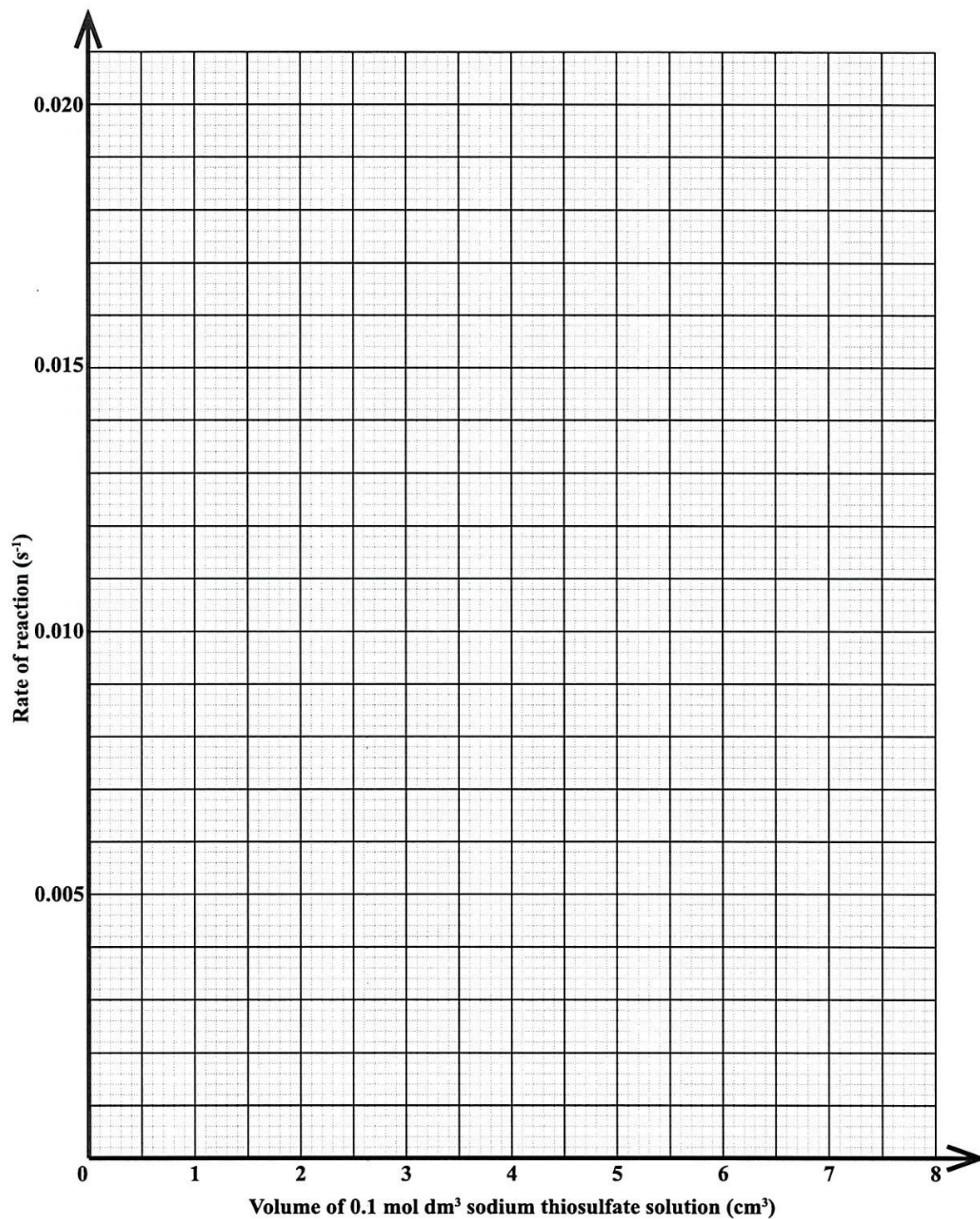


Figure 1. Rate of reaction vs the concentration of sodium thiosulfate

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3. You have been presented with samples of contaminated spring water from Spring A and Spring B. You are required to determine which spring water is more contaminated.

The following information was provided about the contaminant:

- Colourless
- Miscible in water
- Boiling point is 50 °C

Plan and design an experiment to determine which spring water is more contaminated.

The hypothesis is given below:

Hypothesis: Water from Spring A is more contaminated than water from Spring B.

Your answer should include the following:

(a) Procedure

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(3 marks)

(b) Apparatus and materials

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(2 marks)

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CANDIDATE'S RECEIPT

INSTRUCTIONS TO CANDIDATE:

1. Fill in all the information requested clearly in capital letters.

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SUBJECT: CHEMISTRY – Paper 032

PROFICIENCY: GENERAL

REGISTRATION NUMBER:

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FULL NAME: _____
(BLOCK LETTERS)

Signature: _____

Date: _____

2. Ensure that this slip is detached by the Supervisor or Invigilator and given to you when you hand in this booklet.
3. Keep it in a safe place until you have received your results.

INSTRUCTION TO SUPERVISOR/INVIGILATOR:

Sign the declaration below, detach this slip and hand it to the candidate as his/her receipt for this booklet collected by you.

I hereby acknowledge receipt of the candidate's booklet for the examination stated above.

Signature: _____
Supervisor/Invigilator

Date: _____

